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A REVISION OF THE AMERICAN CLUPEID FISHES OF THE GENUS HARENGULA, WITH DESCRIPTIONS OF FOUR NEW SUBSPECIES[1]

By Luis René Rivas

During the course of research on West Indian fishes, under a John Simon Guggenheim Latin American Fellowship, I had occasion to study the collections of American clupeids at the United States National Museum. I found that certain forms of the genus *Harengula* were undescribed, and in determining these it seemed best to revise the whole genus. This paper is the result. Eleven forms of the genus are recognized, including the four new subspecies of *H. pensacolae* Goode and Bean described herein.

In addition to the collections of the National Museum (U.S.N.M.), which include numerous type specimens, material from the following institutions was studied: Museum of Comparative Zoology (M.C.Z.), Bingham Oceanographic Collection (B.O.C.), Chicago Natural History Museum (C.N.H.M.), and Stanford Natural History Museum (S.N.H.M.). In all, 2,042 specimens were examined.

I am grateful to the officials of the above-named institutions for their kind cooperation, especially to the late Dr. Samuel F. Hildebrand and Dr. Leonard P. Schultz, who offered valuable suggestions and read the manuscript critically. The drawings were made by Mrs. Aime M. Awl, artist, U. S. National Museum; and the photographs were taken by the late G. I. Hightower, of the Smithsonian Institution Photographic Laboratory.

[1] Marine Laboratory, University of Miami, Contribution No. 27.

Methods.—I follow Storey (1938, p. 6) in the methods of measuring and counting (scale counts excepted), although some of the measurements used by her, such as body angles, eye depth, preopercle to eye, depth of the opercular bone, gill-cover depth, and head depth at eye, were omitted in the present study. Other measurements and counts not hitherto used in connection with this genus were found to be useful in separating most of the forms. These additional measurements and counts are self-explanatory, with the exception of the following:

The distance between the origin of the dorsal fin and the axis of the body is the vertical distance between the origin of the dorsal fin and the imaginary straight line passing through the center of the caudal peduncle and the center of the eye. The predorsal scales were counted from, and including, the first scale visible between the two enlarged and elongate scales at nape to the (usually notched) scale before the first dorsal ray. The transverse scale rows were counted from the upper end of the opercular margin to the caudal base; the longitudinal rows, between the origins of the dorsal and pelvic fins. The standard length is always referred to as "length" throughout the work.

Only *Harengula pensacolae cubana*, the most distinctive of the new subspecies, is fully described. For the other new subspecies only the distinctive characters are stated. In descriptions, the measurements and counts of the holotype are given first, followed in parentheses by those of the paratypes. A complete synonymy, including all references that have come to my attention, followed by short notes in parentheses referring to the contents of the work, is given for each form. The vernacular names are listed in order of importance; those most widely used are given first. Most vernacular names are local and with few exceptions are applied to all forms found in a given locality. These fishes are called "sardine" in English and French, "sardina" in Spanish, and "sardinha" in Portuguese.

Distribution.—The American forms of the genus *Harengula*, mostly tropical in distribution, are plankton feeders and occur along the coasts, usually congregating in schools swimming near the surface. They are sometimes found several miles offshore, and some forms ascend brackish-water streams for a short distance. The distribution of the species and subspecies is discussed under each form.

Relationships.—It was observed that *H. humeralis* and *H. callolepis* are closely related and form a pair widely spearated from the others. *H. thrissina*, although related to *H. peruana*, differs from the other forms in several important characters. The immediate relationships of *H. clupeola* are difficult to establish, but the species is well separated from the other forms. The subspecies of *H. pensacolae* are very closely related to one another and form a group well distinct from

other American forms. An interesting case of intergradation is shown by the frequency distribution of the number of gill rakers and ventral scutes in *H. pensacolae* and its subspecies (see table 1).

Clupeidae related to Harengula.—The genus *Harengula* belongs to the clupeid fishes possessing a short anal fin (less than 30 rays), no distinct median notch in the upper jaw, and a bilobed dermal fold on the vertical anterior edge of the cleithrum (rim of shoulder girdle). The only other American genera that belong to this group are *Sardinella* Cuvier and Valenciennes (1847, p 261) and *Opisthonema* Gill (1861, p. 37).

The following key should enable one to distinguish *Harengula* from the above-mentioned genera:

1*a*. Gill rakers always more than 45 or lower limb of first arch; ventral scutes always more than 32.
2*a*. Last ray of dorsal fin not produced into a long filament; body slender, length of head greater than greatest depth of body ..... **Sardinella**
2*b*. Last ray of dorsal fin produced into a long filament; body deep, length of head less than greatest depth of body ..... **Opisthonema**
1*b*. Gill rakers always fewer than 45 on lower limb of first arch; ventral scutes never more than 32 ..... **Harengula**

Genus HARENGULA Cuvier and Valenciennes

Harengula Cuvier and Valenciennes, 1847, p. 277 (diagnosis; comparisons; comments; genotype: *Harengula latulus* Cuvier and Valenciennes, 1847, p. 280, pl. 595).—Guichenot, 1853, p. 229 (diagnosis; species).—Gill, 1861, p. 36 (diagnosis).—Poey, 1868, p. 418 (characters; Cuban species).—Jordan and Gilbert, 1882a, p. 268 (characters).—Jordan, 1890, p. 645 (comments; West Indian species); 1918, p. 46 (comments); 1919, p. 231.—Regan, 1917, p. 386 (characters; comparisons; species; range).—Storey, 1938, p. 15 (comments; comparisons; characters).—Hildebrand, 1946, p. 88 (description; Peruvian species.)

Characters distinguishing the West Indian species of *Harengula* were treated in detail by Storey (1938, pp. 15–23), who recognized four from the Atlantic and one from the Pacific, whereas six species and five subspecies are recognized herein from the same general area.

The most important characters are the number of gill rakers and number of ventral scutes (see table 1); they, alone, cannot be used to distinguish the various forms but must be used with certain proportions and other characters of qualitative value. The difficulty of identifying these clupeids by previous keys and descriptions was caused primarily by the omission of gill-raker and ventral-scute counts. The number of scales is nearly uniform, except for *H. thrissina*, in which they are more numerous.

The number of fin rays is very uniform, except the anal in *H. thrissina* and *H. peruana*, both having fewer rays than the other forms.

The depth of the head at occiput and the greatest depth of the body, when measured into the length, are useful proportions serving

TABLE 1.—*Frequency distribution of the number of gill rakers and ventral scutes in the American species and subspecies of* Harengula

Species and subspecies	Length	Gill rakers on lower limb of first arch																Ventral scutes							
		26	27	28	29	30	31	32	33	34	35	36	37	38	39	40		25	26	27	28	29	30	31	32
	Mm.																								
humeralis	44–160	7	31	81	55	4	2											1	19	65	86	2			
callolepis	50–162				8	19	14	3											1	10	28	4			
thrissina	42–112			1	5	11	10	5													1	5	20	5	
peruana	46– 80				1	3	4	9	4	1												4	14	5	
clupeola	43–149			3	10	19	36	36	10	7		1										4	34	51	5
pensacolae majorina	40–140					2	4	3	9	13	10	1	1										7	29	6
pensacolae caribbaea	39–110						1	22	47	37	16	4	1									30	91	7	
pensacolae pensacolae	39–149									4	28	38	58	33	19	3					1	32	102	17	
pensacolae cubana	41–109									2	19	30	37	36	7	2					2	28	91	9	
pensacolae floridana	40–128									2	3	7	9	3	2							4	20	2	
pensacolae pinensis	65– 85												2		3	1						2	4		

to separate the slender from the deeper forms. The greatest width of the head, the distance between the origin of the dorsal fin and the axis of the body, and the least depth of the caudal peduncle, all into the head, have been found to be valuable characters. In general, deep-bodied forms have a shorter head and a smaller eye.

The general coloration is practically the same in all the American forms and varies only in minor details. *H. humeralis* and *H. callolepis* are the only species without the humeral spot. These two species and *H. thrissina* have the tip of the dorsal fin blackish, whereas in the remaining species it is slightly or not at all pigmented.

The American species and subspecies of *Harengula* are closely related and sometimes difficult to separate. They overlap in virtually all counts and proportions, although there is a combination of characters for each form that serves to separate it from the others. The following key, arranged dichotomously, should provide a ready means of identification for them:

KEY TO THE AMERICAN SPECIES AND SUBSPECIES OF HARENGULA

1*a*. Inner edge of palatines with a row of pointed teeth forming a cutting edge; gill rakers less numerous, 26 to 32, usually 27 to 31, on lower limb of first arch; ventral scutes less numerous, 25 to 29, usually 26 to 28; scales not adherent, easily falling off from either fresh or preserved specimens; distance between origins of pelvic and anal fins shorter 3.7 to 5.0, usually 3.8 to 4.5, in length; snout longer, 2.5 to 3.4, usually 2.6 to 3.3, in distance between origins of pelvic and anal fins; humeral spot absent; average length 82 to 140 mm.

2*a*. Gill rakers less numerous, 26 to 31, usually 27 to 29, on lower limb of first arch (see table 1); head deeper, its depth at occiput 3.7 to 4.0, usually 3.8 or 3.9, in length; distance between occiput and origin of dorsal fin 1.4 to 1.6, usually 1.5, in greatest depth of body; body deeper, its greatest depth 2.9 to 3.3, usually 3.0 to 3.2, in length; eye larger, 1.7 to 2.2, usually 1.8 to 2.1, in distance between occiput and origin of dorsal fin; average length 82 to 106 mm.; Florida Keys, Bahamas, West Indies, and Atlantic coast of Central and South America from Yucatán to Venezuela.

1. Harengula humeralis

2*b*. Gill rakers more numerous, 29 to 32, usually 30 or 31, on lower limb of first arch (see table 1); head less deep, its depth at occiput 4.1 to 4.4, usually 4.2 or 4.3, in length; distance between occiput and origin of dorsal fin 1.1 to 1.3, usually 1.2, in greatest depth of body; body less deep, its greatest depth 3.3 to 3.9, usually 3.4 to 3.8, in length; eye smaller, 2.1 to 2.7, usually 2.2 to 2.6, in distance between occiput and origin of dorsal fin; average length 109 to 140 mm.; Bermudas__2. **Harengula callolepis**

1*b*. Inner edge of palatines without a row of pointed teeth; gill rakers more numerous, 28 to 40, usually 30 to 39, on lower limb of first arch; ventral scutes more numerous, 28 to 32; scales adherent, not falling off from either fresh or preserved specimens; distance between origins of pelvic and anal fins longer, 3.1 to 3.9, usually 3.3 to 3.7, in length; snout shorter, 3.4 to 4.3, usually 3.5 to 4.2, in distance between origins of pelvic and anal fins; humeral spot present, sometimes faint; average length 42 to 91 mm.

3*a*. Gill rakers less numerous, 28 to 37, usually 30 to 35, on lower limb of first arch; ventral scutes 29 to 32, usually 30 or 31; Florida Keys, Bahamas, West Indies, Atlantic coast of Central and South America from Yucatán to Brazil, and Pacific coast from the Gulf of California to Peru.

4*a*. Scales more numerous, in 42 to 44, usually 43, transverse rows and 12 or 13, usually 12, longitudinal rows; predorsal scales 15 to 19, usually 16 to 18; Pacific coast of Mexico from the Gulf of California to Acapulco---------- 3. **Harengula thrissina**

4*b*. Scales less numerous, in 38 to 42, usually 39 to 41, transverse rows and 11 longitudinal rows; predorsal scales 11 to 14, usually 12 or 13; Florida keys, West Indies, Atlantic coast of Central and South America from Yucatán to Brazil, and Pacific coast from Panama to Peru.

5*a*. Anal rays less numerous, 15 to 17, usually 16; anal base usually slightly shorter than pelvic fins; tip of dorsal fin blackish; Pacific coast from Panama to Peru---------- 4. **Harengula peruana**

5*b*. Anal rays more numerous, 17 to 19, usually 18; anal base usually slightly longer than pelvic fins; tip of dorsal fin not blackish; Florida Keys, Bahamas, West Indies, and Atlantic coast of Central and South America from Yucatán to Brazil.

6*a*. Gill rakers less numerous, 28 to 34, usually 29 to 33, on lower limb of first arch (see table 1); head less deep, its depth at occiput 3.7 to 4.1, usually 3.8 to 4.0, in length; 1.7 to 1.9, usually 1.8, in predorsal length; body more slender, its greatest depth 2.9 to 3.6, usually 3.0 to 3.5, in length; 1.3 to 1.7, usually 1.4 to 1.6, in predorsal length; distance between occiput and origin of dorsal fin 1.2 to 1.6, usually 1.3 to 1.5, in greatest depth of body; caudal peduncle more slender, its least depth 4.1 to 4.8, usually 4.2 to 4.7, in predorsal length; distance between origin of dorsal and center of eye usually greater than greatest depth of body; Florida Keys, Bahamas, West Indies, and Atlantic coast of Central and South America from Yucatán to Brazil-- 5. **Harengula clupeola**

6*b*. Gill rakers more numerous, 30 to 37, usually 32 to 35, on lower limb of first arch (see table 1); head deeper, its depth at occiput 3.1 to 3.8, usually 3.2 to 3.7, in length; 1.4 to 1.7, usually 1.5 or 1.6, in predorsal length; body deeper, its greatest depth 2.5 to 3.0, usually 2.6 to 2.9, in length; 1.1 to 1.3 in predorsal length; distance between occiput and origin of dorsal 1.6 to 2.1, usually 1.7 to 2.0, in greatest depth of body; caudal peduncle deeper, its least depth 3.4 to 4.1, usually 3.7 to 3.9 in predorsal length; distance between origin of dorsal and center of eye usually less than greatest depth of body; West Indies (Jamaica, Hispaniola, Puerto Rico) and Atlantic coast of Central and South America from Nicaragua to Brazil.

7*a*. Ventral scutes more numerous, 30 to 32, usually 31 (see table 1); eye smaller, 3.4 to 4.5, usually 3.6 to 4.0, in greatest depth of body; West Indies from St. Lucia southward, and Atlantic coast of South America from Venezuela to Brazil.
6. **Harengula pensacolae majorina**

7*b*. Ventral scutes less numerous, 29 to 31, usually 30 (see table 1); eye larger, 3.1 to 4.2, usually 3.3 to 3.7, in greatest depth of body; West Indies (Jamaica, Hispaniola, Puerto Rico) and Atlantic coast of Central and South America from Nicaragua to Colombia---------- 7. **Harengula pensacolae caribbaea**

3*b*. Gill rakers more numerous, 34 to 40, usually 35 to 39, on lower limb of first arch; ventral scutes 28 to 31, usually 29 or 30, most frequently 30; east coast of United States from North Carolina southward to Florida Keys and along Gulf coast to Yucatán, also Bahamas, western Cuba, and Isle of Pines.

8*a*. Head shorter and deeper, its length 3.4 to 3.9, usually 3.5 to 3.8, in length, its depth at occiput 3.1 to 3.5, usually 3.2 to 3.4, in length; body deeper, its greatest depth 2.3 to 3.0, usually 2.5 to 2.8, in length; origin of dorsal fin usually nearer tip of snout than to origin of anal; caudal peduncle deeper, its least depth 1.7 to 2.1, usually 1.8 to 2.0, in distance between occiput and tip of snout; eye smaller, 3.6 to 4.5, usually 3.7 to 4.4, in greatest depth of body; east coast of United States from North Carolina southward to Florida Keys and along Gulf coast to Yucatán; Bahamas---------- 8. **Harengula pensacolae pensacolae**

8*b*. Head longer and less deep, its length 3.1 to 3.4, usually 3.2 or 3.3, in length, its depth at occiput 3.4 to 4.1, usually 3.5 to 3.9, in length; body less deep, its greatest depth 2.8 to 3.3, usually 2.9 to 3.1, in length; origin of dorsal fin usually nearer origin of anal than to tip of snout; caudal peduncle more slender, its least depth, 1.9 to 2.6, usually 2.0 to 2.5, in distance between occiput and tip of snout; eye larger, 2.6 to 3.7, usually 2.8 to 3.6, in greatest depth of body; Florida Keys, western Cuba, and Isle of Pines.

9*a*. Predorsal contour more convex and less steep, the back less elevated; distance between origin of dorsal fin and axis of body 2.2 to 2.7, usually 2.3 to 2.6, in head; head less compressed, its greatest width 2.1 to 2.4, usually 2.2 or 2.3, in greatest depth of body; body less deep, its greatest depth 2.9 to 3.3, usually 3.0 or 3.1, in length, 1.3 to 1.6, usually 1.4 or 1.5, in predorsal length; caudal peduncle more slender, its least depth 2.6 to 3.0, usually 2.7 to 2.9, in head; 2.1 to 2.6, usually 2.2 to 2.5, in distance between occiput and tip of snout; eye larger, 2.5 to 2.9, usually 2.6 to 2.8, in head; 2.6 to 3.6, usually 2.8 to 3.4, in greatest depth of body, its diameter equal to or greater than least depth of caudal peduncle and exceeding its vertical distance above ventral contour of head; interorbital 1.7 to 2.1, usually 1.8 to 2.0, in eye; Florida Keys and western Cuba.

10*a*. Head less deep, its depth at occiput 3.5 to 4.1, usually 3.6 to 4.0, in length (see table 3); north coast of western Cuba, from Ensenada de Matahambre to Cape Cajón.

9. **Harengula pensacolae cubana**

10*b*. Head deeper, its depth at occiput 3.4 to 3.8, usually 3.5 to 3.7, in length (see table 3); Florida Keys, from Old Rhodes Key to Key West---------- 10. **Harengula pensacolae floridana**

9*b*. Predorsal contour less convex and steeper, the back more elevated; distance between origin of dorsal fin and axis of body 2.1 or 2.2 in head; head more compressed, its greatest width 2.4 to 2.6, usually 2.5, in greatest depth of body; body deeper, its gretaest depth 2.8 to 3.0, usually 2.9, in length; 1.2 or 1.3 in predorsal length; caudal peduncle deeper, its least depth 2.3 to 2.6, usually 2.4 or 2.5, in head, 1.9 to 2.1, usually 2.0, in distace between occiput and tip of snout; eye smaller, 2.8 to 3.0, usually 2.9, in head, 3.4 to 3.7 in greatest depth of body, its diameter less than least depth of caudal peduncle and not exceeding its vertical distance above ventral contour of head; interorbital 1.5 to 1.7 in eye; Isle of Pines.

11. **Harengula pensacolae pinensis**

1. HARENGULA HUMERALIS (Cuvier)

SARDINA; SARDINA DE LEY; SARDINE; LOOSE-SCALED SARDINE; PILCHARD; RED-EARED PILCHARD; SPRAT; WHITEBILL; PINCERS

"Sardine des Antilles" DUHAMEL, 1776, p. 548 (description; Guadeloupe), pl. 31, fig. 4 (drawing).

Clupea humeralis (not *Harengula humeralis* Cuvier and Valenciennes, 1847, p. 293) CUVIER, 1829, p. 318, footnote 2 (name only, applied to Duhamel's fig. 4 of "Sardine des Antilles"); 1843, p. 274, footnote 1 (on "Sardine des Antilles" of Duhamel).—JORDAN, 1887b, p. 561 (synonymy in part; West Indies).

Harengula maculosa CUVIER and VALENCIENNES, 1847, p. 292 (original description; life colors; Martinique).—REGAN, 1917, p. 387 (synonymy; description; range: exclude Bermudas; Florida, West Indies).—JORDAN, 1918, p. 46 (validity; occurrence).—FOWLER, 1930b, p. 269 (Grenada).—JORDAN, EVERMANN, and CLARK, 1930, p. 43 (partial synonymy; West Indies).—STOREY, 1938, p. 41 (nomenclatorial notes).—LONGLEY and HILDEBRAND, 1941, pp. 8 (characters in key), 9 (synonymy; remarks; occurrence; life colors; characters; range; Tortugas, Fla.).

Alosa apicalis MÜLLER and TROSCHEL, 1848, p. 675 (original description; Barbados).—HILL, 1881, p. 125 (common name; comments; Jamaica).—STOREY, 1938, p. 41 (nomenclatorial notes; original description quoted).

Harengula sardina POEY, 1860, p. 310 (original description; Cuba); 1861, p. 384 (Cienfuegos, Cuba); 1866a, p. 16 (common name; species poisonous; Cuba); 1868, p. 418 (common name; characters; comparison; Cuba); 1876, p. 147 (common name; references; comparisons; range of *H. humeralis* Cuvier and Valenciennes, 1847, p. 293; Cuba).—JORDAN and BOLLMAN, 1889, p. 550 (Green Turtle Cay, Bahamas).—JORDAN, 1890, p. 645 (comments).—BEAN, 1890, p. 206 (material; length; Cozumel, Yucatán).—JORDAN and THOMPSON, 1905, p. 233 (occurrence; Tortugas, Fla.).—FOWLER, 1906, p. 83 (Hailer's Rock, Fla.), fig. 2 (drawing); 1926, p. 250 (material; scales; coloration; Boca Grande, Fla.).—NICHOLS, 1929, p. 202 (common names; partial synonymy; type locality; distribution; material; diagnosis; Puerto Rico).—JORDAN, EVERMANN, and CLARK, 1930, p. 43 (common name; synonymy in part; range).—LONGLEY, 1932, p. 299 (synonymy; Tortugas, Fla.).—STOREY, 1938, p. 41 (nomenclatorial notes).—HOWELL-RIVERO, 1938, p. 171 (partial synonymy; type material; holotype designated; Cuba).—BUTSCH, 1939, p. 18 (common name; Barbados).

?*Harengula jaguana* POEY, 1865, p. 189 (comments; original description; Bahía de Jagua, Cienfuegos, Cuba); 1868, p. 418 (characters; comparison; Cuba); 1876, p. 147 (common name; references; type locality; characters; Bahía de Jagua, Cuba).—JORDAN, 1886, p. 33 (comparison).—STOREY, 1938, p. 41 (nomenclatorial notes).

Clupea macrophthalma (not of Ranzani, 1842, p. 320), GÜNTHER, 1868, p. 421 (synonymy in part; description; range; West Indies).

Clupea apicalis, GÜNTHER, 1868, p. 441 (description; Barbados).—JORDAN, 1887b, p. 561 (reference; West Indies).—COCKERELL, 1892, p. 15 (description; Jamaica).

Clupea sardina, JORDAN, 1884, p. 106 (abundance; habitat; comparisons; description; material; Key West, Fla.); 1886, p. 33 (common name; comments; Habana); 1887a, p. 36, footnote 1 (common names; description; range; comparison; synonymy in part); 1887b, p. 561 (West Indies).—JORDAN and SWAIN, 1884, p. 230 (relationship; scales).

Clupea sp. LEE, 1889, p. 672 (common name; material; Nassau, Bahamas).

Harengula clupeola (not *Clupea clupeola* Cuvier, 1829, p. 318), JORDAN, 1890, pp. 646 (characters in key; Key West, Fla., and Habana), 647 (common name; synonymy in part; St. Lucia, West Indies).

Sardinella apicalis, JORDAN and EVERMANN, 1896a, pp. 428 (characters in key), 429 (description; partial synonymy; Barbados); 1896b, p. 282 (range).

Sardinella sardina, JORDAN and EVERMANN, 1896a, pp. 428 (characters in key), 430 (common name; description; range; synonymy); 1896b, p. 282 (common name; range).—B. A. BEAN, 1905, p. 297 (common name; range; abundance; Nassau, Bahamas).—BARBOUR and COLE, 1906, p. 156 (material; Progreso, Yucatán).—FOWLER, 1911, p. 206 (Hailer's Rock, Fla.).—ROSÉN, 1911, p. 48 (Nassau and Green Turtle Cay, Bahamas).—NICHOLS, 1912, p. 182 (market, Habana); 1915, p. 141 (San Juan Harbor, Puerto Rico); 1921, p. 22 (Turk Islands, Bahamas).—METZELAAR, 1919, p. 11 (?; partial synonymy; size; common name; habitat; Fuikbay, Curaçao; Aruba), fig. 3 (drawing).—MEEK and HILDEBRAND, 1923, p. 183 (synonymy in part; description; range; Atlantic coast of Panama).—BEEBE and TEE-VAN, 1928, p. 40 (common name; references; characters; size, weight, color; range; distribution, abundance; method of capture; food; young; material; Port-au-Prince Bay, Haiti), fig. (outline drawing).—BREDER, 1929, p. 68 (common name; range; feeding habits; size; Florida).—PARR, 1930, p. 2 (material; New Providence, Crooked Island, West Caicos, and Turk Island, Bahamas).

Sardinella humeralis (not *Harengula humeralis* Cuvier and Valenciennes, 1847, p. 293), EVERMANN and GOLDSBOROUGH, 1902, p. 149 (common name; description; comments; material; Puerto Morelos, Yucatán).

Sardinella macrophthalma (not *Clupea macrophthalma* Ranzani, 1842, p. 320), EVERMANN and MARSH, 1902, p. 85 (common name; description; comments; range; material; synonymy in part; San Juan, Puerto Real, Culebra, and Fajardo, Puerto Rico).—BREDER, 1927, p. 12 (material in part; Royal Island, Bahamas; Point Francis, Isle of Pines; Glover Reef, British Honduras).

Sardinella maculosa, VON IHERING, 1930, p. 228 (references; common names; diagnosis; comments; ?Brazil).

Harengula macrophthalma (not *Clupea macrophthalma* Ranzani, 1842, p. 320), FOWLER, 1937, p. 309 (Haiti).

Harengula humeralis, STOREY, 1938, pp. 13, 15, 21 (characters), 23 (relationships; range), 24 (key), 28 (synonymy; description; diagnosis; material; St. Lucia; Glover Reef; Jamaica; Cuba; Florida Keys; Bahamas), 39, 50 (nomenclatorial notes; original description quoted).—FOWLER, 1942a, p. 66 (common names; use; size; comparison; Cojímar, Cuba); 1942b, p. 9 (common name; material; size; length of ventral fin; Bonacca Island, Honduras); 1944, pp. 70 (synonymy and references; description; material; comparison; Serranilla Bank), 93, fig. 27 (drawing), 434 (references; Bahamas), 456 (references; western Carribbean).

Material from Barbados (U.S.N.M. Nos. 120774 and 123674) confirms that *Alosa apicalis* Müller and Troschel (1848, p. 675) is a synonym of *Harengula humeralis*.

Storey (1938, pp. 28, 41) recorded U.S.N.M. No. 4794, two specimens 98 and 125 mm. in length sent from Cuba by Poey, as the types of *Harengula sardina* Poey (1860, p. 310), and M. C. Z. No. 17868, a specimen 122 mm. in length, and No. 17736, two specimens 97 and 116 mm. in length , also sent by Poey from Cuba, as cotypes; but later Howell-Rivero (1938, p. 171) recorded these M.C.Z. numbers as holotype and paratypes respectively of this nominal species. After

having examined the above-mentioned specimens and compared them with the original description of *H. sardina*, I conclude that M.C.Z. No. 17868 is the only specimen that can be accepted as the holotype; the rest are paratypes. It agrees with the original description in every respect, except that the ventral-scute count is 27 instead of 25. A count of 25 ventral scutes is very rare in this species (see table 1) and there is the possibility that a typographical error was made in the original publication or that Poey made a mistake in his count. The specimen 125 mm. in length, U.S.N.M. No. 4794, also agrees with the original description in almost every respect but has a scute count of 28. In my opinion the decisive factor in favor of M.C.Z. No. 17868 as being the holotype of *H. sardina* is that Poey, in his original description, states that "la ligne du ventre est plus prononcée que celle du dos," which is true of this specimen. The U. S. N. M. specimen, in contrast, has the dorsal outline more pronounced than the ventral (an obvious artifact in preservation). In this species the dorsal and ventral outlines have approximately the same curvature.

I follow Storey (1938, pp. 28, 41) in placing, with reservations, *Harengula jaguana* Poey (1865, p. 189) from Cuba in the synonymy of *H. humeralis*. This species was originally described from Bahía de Jagua (Cienfuegos Bay), southern Cuba, and is still known only from the original description; the types, apparently, have been lost. The status of this little-known species might be clarified by the study of material from the type locality.

The material (U.S.N.M. No. 38469) recorded from Nassau, Bahamas, by Lee (1889, p. 672) as *Clupea* sp. is *H. humeralis*. The material recorded by Breder (1927, pp. 12, 13) as *Sardinella macrophthalmus* I observed to be a mixture of two species: No. 14, a specimen 126 mm. in length from Royal Island, Bahamas; No. 15, a specimen 102 mm. in length from Port Francis, Isle of Pines; and two specimens 122 and 139 mm. in length in No. 16, from Glover Reef, are *H. humeralis*. The remaining seven specimens in No. 16 are *H. clupeola*. I have not seen No. 17 (1 specimen), from Siguanea Bay, Isle of Pines.

Together with *H. callolepis*, *H. humeralis* is widely separated from all the other American members of the genus by a number of characters, as shown in item 1*a* of the key, already pointed out by Storey (1938, p. 23), but she did not recognize *H. callolepis* as a valid species.

A very distinctive character not hitherto used and common to *H. humeralis* and *H. callolepis* is the presence of a row of pointed teeth forming a cutting edge on the inner side of the palatines. This character, and those already referred to, might justify a new subgenus, as suggested by Storey (1938, p. 23), but no subgeneric distinction should be attempted until a thorough study of the Indo-Pacific species is made.

Another character serving to separate *H. humeralis* and *H. callolepis* from the rest of the Atlantic species is the pigmentation at the tip of the dorsal fin, which is always blackish regardless of the preservative used, whereas in the other forms from the Atlantic it is very lightly or not at all pigmented.

Harengula humeralis and *H. callolepis* are the largest of the American forms and are reported to grow up to 8 inches (about 200 mm.) in total length. The largest specimen of *H. humeralis* (U.S.N.M. No. 116873) examined was 160 mm. long, collected along with others by W. H. Longley at Tortugas, Fla. The usual length of the species is 82 to 106 mm.

Harengula humeralis, a fairly abundant species, is used as bait as well as food, although it has been reported as slightly poisonous by some authors (Poey, 1866a, p. 16).

The geographical range of *Harengula humeralis* comprises the Florida Keys, Bahamas, West Indies, and the Atlantic (Caribbean) coast of Central and South America, from Yucatán to Venezuela. It is possible that this species occurs along the coasts of the Guianas and northern Brazil, but no definite record is known. The specimens doubtfully recorded from Natal, Brazil, by Starks (1913, p. 8) as *Sardinella sardina* might be *Harengula pensacolae majorina*, but I have not seen the specimens. In addition, 49 lots with 267 specimens were examined.

2. HARENGULA CALLOLEPIS Goode

PILCHARD

FIGURE 38

Harengula macrophthalma (not *Clupea macrophthalma* Ranzani, 1842, p. 320), GOODE, 1876, pp. 10 (use as bait), 13 (species of Bermudas and West Indies), 69 (common name; synonymy excluded; occurrence; range in part; abundance; length; Bermudas); 1877, p. 6 (common name; Bermuda).—BARBOUR, 1905, p. 112 (common name; distribution excluded; fin rays; scales; material; method of capture; abundance; occurrence; Bermuda).

Harengula callolepis GOODE, *in* Goode and Bean, 1879, p. 152 (original description; comparisons; Bermudas).—STOREY, 1938, pp. 4 (remarks), 41 (nomenclatorial notes).

Clupea callolepis, JORDAN, 1887b, p. 561 Bermuda).

Sardinella humeralis (not *Harengula humeralis* Cuvier and Valenciennes, 1847, p. 293), T. H. BEAN, 1906, p. 34 (common name; material; Bermuda).

Sardinella macrophthalmus (not *Clupea macrophthalma* Ranzani, 1842, p. 320), T. H. BEAN, 1906, p. 34 (common name; material; Bermuda).

Harengula maculosa (not of Cuvier and Valenciennes, 1847, p. 292), FOWLER, 1930a, p. 145 (material; size; Bermuda).

Harengula sardina (not of Poey, 1860, p. 310), BEEBE and TEE-VAN, 1933, p. 35 (common name; field characters; diagnosis in part; distribution in part; Bermuda), fig. (drawing).

Harengula sp. HOLLISTER, 1936, pp. 282–284 (caudal skeleton, material; Bermuda).

This species, hitherto considered by most authors as a synonym of *H. humeralis*, has been found to be distinct.

The material (C.N.H.M. Nos 5305, 5306, 5309) recorded from Bermuda as *Sardinella humeralis* by T. H. Bean (1906, p. 34) was found to be *H. callolepis*. The two specimens (C.N.H.M. No. 5310) recorded as *S. macrophthalmus* are *H. callolepis*.

H. callolepis is closely related to *H. humeralis*, but a number of characters, as well as the geographical distribution, definitely separate the two species, as may be seen by the examination of items 2*a* and 2*b* of the key.

FIGURE 38.—*Harengula callolepis* Goode: From a specimen 141 mm. in length (C.N.H.M. No. 5305), collected at Well Bay, Cooper Island, Bermudas.

Judged from the material at hand, *H. callolepis* seems to reach a slightly larger size than *H. humeralis*. The usual length, calculated from the material studied, is 109 to 140 mm., and the largest specimen examined (C.N.H.M. No. 5310) was 162 mm. long. It was collected along with another 158 mm. by T. H. Bean in Shelly Bay, Bermuda, in 1905.

This is the only species of *Harengula* so far known from Bermuda, where it is fairly common and is marketed as food as well as bait. It has never been taken outside of the Bermuda Islands.

The material examined comprised 10 lots and 52 specimens.

3. HARENGULA THRISSINA (Jordan and Gilbert)

SARDINA

PLATE 3, FIGURES 1–2

Clupea thrissina JORDAN and GILBERT, 1882b, p. 353 (original description; comparison; material; Cape San Lucas).—JORDAN, 1885, p. 366 (Cape San Lucas); 1887, p. 36 (Cape San Lucas).

Harengula pensacolae (not of Goode and Bean, 1879, p. 152), VAILLANT, 1894, p. 71 ("Basse-Californie et dans le Golfe").

Sardinella thrissina, JORDAN and EVERMANN, 1896a, p. 430 (description; types designated; Gulf of California); 1896b, p. 282 (Gulf of California).—KENDALL and RADCLIFFE, 1912, pp. 80 (references; material: specimens from Acapulco

only; scales; fin rays), 167 (distribution: coast of Mexico only.)—Osburn and Nichols, 1916, p. 149 (common name; method of capture; Pichilinque Bay, Agua Verde Bay, and Carmen Island, Lower California).—Breder, 1928, p. 5 (material; Espíritu Santo, Salina Bay in Carmen Island, Arroyo de San Luis, and San José, Lower California).

Harengula thrissina, Regan, 1917, p. 387 (characters in key; references; description; range; material; Jalisco, Mexico).—Jordan, Evermann, and Clark, 1930, p. 44 (range).—Storey, 1938, pp. 3, 21, 23, 35, 51 (comments; characters; types in part; description; material; Río Mulegé, Concepción Bay, Lower California, and "West Coast of Mexico").—Seale, 1940, p. 3 (material; Tangola-Tangola and Tenacatita, Mexico).—Fowler, 1944, pp. 358 (material; coloration; Acapulco, Mexico), 387 (material; coloration; María Madre Island, Tres Marías group, Mexico), 405 (description; coloration; material; Isabel Island, Mexico), 481 (localities, except Panama).

Jordan and Gilbert (1882b, p. 353), in their original description, listed U. S. N. M. Nos. 6388, 2524, and 6339 as the types of this species. I have examined these lots with the exception of No. 6339, which I have not been able to locate. No. 6388 consists of three specimens collected by J. Xantus in Cape San Lucas, Lower California. They are in fairly good condition except for broken caudals, and I designate the largest, 102 mm. in length, as the lectotype. The two remaining specimens in this lot, 83 and 85 mm. in length, are paratypes. The two specimens now in No. 2524 are *Pomolobus pseudoharengus*, an Atlantic species of clupeid that does not occur in the Pacific.

In *H. thrissina*, the scale counts (see item 4*a* of the key) are higher than in any other of the American members of the genus. It resembles *H. clupeola* in proportions, and the scales are thin and glassy as in *H. humeralis* and *H. callolepis* but more adherent, not easily falling off from either fresh or preserved specimens. The tip of the dorsal fin is blackish.

The usual length of *H. thrissina*, as calculated from the material at hand, is 76 to 91 mm. The largest specimen examined (B. O. C. No. 1029) measures 112 mm. in length and was collected by the *Pawnee*, along with several others, in Espíritu Santo Island, Gulf of California (Breder, 1928, p. 5).

This species is known only from the Gulf of California to Acapulco, Pacific coast of Mexico, though further exploration may increase its known range. Six lots and 29 specimens were examined in addition to the type specimens.

4. HARENGULA PERUANA Fowler and Bean

Sardina

Figure 39; Plate 3, Figures 3–4

Sardinella thrissina (not of Jordan and Gilbert, 1882b, p. 353), Kendall and Radcliffe, 1912, p. 80 (Taboguilla Island only).—Meek and Hildebrand,

1923, p. 185 (synonymy excluded; references in part; description; comparisons; range in part; Taboga Island, Gulf of Panama).—Herre, 1936, p. 30 (synonymy and references in part; diagnosis; coloration; material; South Seymour and Eden Islands, Galápagos).—Fowler, 1938, p. 249 (South Seymour and Eden Islands, Galápagos); 1944, pp. 206 (synonymy excluded; references in part; coloration; material; Playa Muerto, Panama), 481 (localities except Mexico).—Hildebrand, 1946, p. 88 (synonymy in part; description; comparison; material; range in part; Panama Bay, Peru).

Harengula peruana Fowler and Bean, 1923, p. 2 (original description; Callao, Peru).—Storey, 1938, p. 51 (compared to *H. thrissina;* on type specimen; type locality doubtful).—Fowler, 1940a, p. 745, fig. 6 (type; Callao, Peru); 1944, p. 482 (Callao, Peru).

The above synonymy and references indicate that this species has been confused with *H. thrissina.*

The material recorded as *Sardinella thrissina* by Kendall and Radcliffe (1912, p. 80; U.S.N.M. No. 65648) and Meek and Hildebrand (1923, p. 186; U.S.N.M. No. 79516), from Panama Bay, was compared with the holotype of *H. peruana,* a specimen 94 mm. in length (U.S.N.M. No. 83156), collected by the Wilkes Exploring Expedition, in Callao, Peru, with which they agree in proportions as well as in counts. That material, including that by Hildebrand (1946, p. 88), differs from the types of *H. thrissina* and other specimens from the Gulf of California and Acapulco, Mexico, in the characters given in the following paragraph.

Figure 39.—*Harengula peruana* Fowler and Bean: From a specimen 80 mm. in length (U.S.N.M. No. 128376), collected at Balboa, Canal Zone, Panama.

H. peruana differs from *H. thrissina* chiefly in the number of scales and gill rakers (see item 4*b* of the key, and table 1), the depth of the body (2.7 to 3.2, usually 2.8 to 3.1, in length in *H. peruana,* and 3.0 to 3.7, usually 3.2 to 3.5, in *H. thrissina*), the head depth at occiput (3.5 to 3.9, usually 3.6 to 3.8, in length in *H. peruana,* and 3.9 to 4.1, usually 4.0, in *H. thrissina*), and the less strongly pigmented dorsal fin. Characters in common with *H. thrissina* are the number of anal rays (15 to 17, usually 16) and the small eye. The number of anal

rays alone would serve to separate both species from all other American forms.

This species does not reach a large size. The largest specimen examined (U.S.N.M. No. 128376), collected by S. F. Hildebrand, at Balboa, Canal Zone, Panama, has a length of 80 mm. The usual length (Herre, 1936, p. 30; Fowler, 1944, p. 206) is 42 to 53 mm.

The range of *Harengula peruana* extends from Panama Bay southward to Peru.

In addition to the holotype, 8 lots with 34 specimens were examined.

5. HARENGULA CLUPEOLA (Cuvier)

SARDINA ESCAMUDA; SPRAT; PETIT CAILLEU

PLATE 3, FIGURES 5–6

"Petit cailleu" DUHAMEL, 1776, p. 546, pl. 31, fig. 2 (description; Guadeloupe)

Clupea clupeola CUVIER, 1829, p. 318, footnote 2 (name only, applied to Duhamel's fig. 2 of "Petit cailleu"); 1843, p. 274, footnote 1 (on "Petit cailleu" of Duhamel).—JORDAN, 1884, p. 107 (comparison; characters); 1887a, p. 33 (comparisons; Habana, Cuba); 1887b, p. 561 (synonymy in part; West Indies).—STOREY, 1938, p. 42 (comments).

Clupea macrophthalma RANZANI, 1842, p. 320, pl. 23, fig. 1–4 (original description; ? Brazil).—COPE, 1871, p. 483 (New Providence, Bahamas).—JORDAN, 1887b, p. 561 (synonymy and reference excluded; West Indies).—COCKERELL, 1892, p. 15 (teeth; coloration; Jamaica).—STOREY, 1938, p. 44, fig. 15 (characters; comparisons; on holotype).

Harengula latulus (not *Clupea latulus* Cuvier, 1829, p. 318), CUVIER and VALENCIENNES, 1847, p. 280, pl. 595 (original description; ? Caen, ? Dieppe).—STOREY, 1938, pp. 3, 36, fig. 15 (comments, nomenclatorial notes; type locality doubtful; on cotype; compared with *H. clupeola*).

Harengula clupeola, CUVIER and VALENCIENNES, 1847, p. 289 (description; common names in part; Martinique).—GOSSE, 1851, pp. 210, 289 (occurrence; use as bait; enemies; behavior; Jamaica).—GUICHENOT, 1853, p. 230 (common name excluded; diagnosis; comments; Cuba).—POEY, 1860, p. 310 (compared with *H. sardina*); 1861, pp. 384 (comparison), 395 (doubtfully occurring in Cuba); 1866b, p. 378 (reference; range; Cuba); 1876, p. 147 (common name; reference; comments; range; Cuba).—HILL, 1881, p. 126 (Jamaica).—JORDAN and BOLLMAN, 1889, p. 550 (Green Turtle Cay, Bahamas).—JORDAN EVERMANN, and CLARK, 1930, p. 43 (common name; range; reference; West Indies).—STOREY, 1938, pp. 3, 13, 15, 23, 24, 29, 42, 51, figs. 1–3, 7–9, 11, 14, 16, 17 (relationships; range; characters; synonymy; description; diagnosis; material; Panama, Glover Reef, St. Lucia, Puerto Rico, Jamaica, Cuba, Garden Key, Bahamas), 49, 50 (nomenclatorial notes on *H. clupeola* Cuvier and Valenciennes, 1847, p. 289, and on Poey's No. 377 species dubia, 1861, p. 384, 395).—FOWLER, 1939, p. 28 (common name; Bimini, Bahamas); 1941, p. 133 (Brazil); 1942b, p. 9 (material; ventral fin; Sheen Cay, Honduras); 1944, p. 124 (synonymy; references; description; material; Old Providence Island), 434 (Bahamas), 456 (western Caribbean; Honduras), fig. 28 (drawing).

? *Alosa bishopi* MULLER and TROSCHEL, 1848, p. 675 (original description; comparisons; size; use as food; Barbados).—HILL, 1881, p. 125 (common

name; comments; Jamaica).—Storey, 1938, p. 49 (nomenclatorial notes; original description quoted).

Harengula species dubia Poey, 1861, p. 384 (common name; close to *H. clupeola*; material; Cuba); 1868, p. 418 (common name; description; compared with *H. clupeola*; Cuba.—Storey, 1938, p. 49 (comments; material).

Clupea humeralis (not *Harengula humeralis* Cuvier and Valenciennes, 1847, p. 293), Gunther, 1868, p. 422 (synonymy and reference in part; description in part; range in part; material in part).

Harengula pensacolae (not of Goode and Bean, 1879, p. 152), T. H. Bean, 1890, p. 206 (material; Cozumel, Yucatán).

Harengula macrophthalma, Jordan, 1890, pp. 645 (listed), 646 (characters in key; synonymy and references in part; Port Castries, St. Lucia); 1918, p. 46 (Atlantic coast species).—Jordan and Thompson, 1905, p. 233 (occurrence; material; Garden Key, Tortugas, Fla.).—Fowler, 1915a, p. 257 (St. Vincent Island, Lesser Antilles); 1919, p. 133 (St. Martin Island, Lesser Antilles); 1928, p. 462 (material; Puerto Rico); 1930b, p. 269 (material; Grenada); 1937, p. 309 (Haiti).—Regan, 1917, p. 388 (synonymy in part; description; range; material in part; Florida, West Indies, Bahia; Fernando Noronha excluded).—Nichols, 1929, p. 202 (common names; synonymy and references in part; distribution; diagnosis; remarks; habits; figure; Puerto Rico).—Jordan, Evermann, and Clark, 1930, p. 43 (common names; range; synonymy in part).—Storey, 1938, p. 43 (nomenclatorial notes; on type locality; original description quoted).—Butsch, 1939, p. 18 (common name; occurrence; Barbados).—Longley and Hildebrand, 1941, pp. 8 (characters in key), 9 (occurrence; comparison), 10 (synonymy in part; variation in depth according to sex; occurrence; material; fin rays; ventral scutes; gill rakers; comparison; nomenclatorial notes; range; Tortugas, Fla.).

Clupea bishopi, Cockerell, 1892, p. 15 (coloration; Jamaica).

Sardinella clupeola, Jordan and Evermann, 1896a, pp. 428 (characters in key), 429 (common name; description in part; nomenclatorial notes; reference); 1896b, p. 282 (range).—B. A. Bean, 1905, p. 297 (Green Turtle Cay, Bahamas).—Rosén, 1911, p. 48 (Green Turtle Cay, Bahamas).—Metzelaar, 1919, p. 11 (synonymy; size; Haiti), fig. 10 (drawing, erroneously identified as *Sardinella anchovia* Cuvier and Valenciennes, 1847, p. 269).

Sardinella bishopi, Jordan and Evermann, 1896a, pp. 428 (characters in key), 430 (description; relationships); 1896b, p. 282 (range).

Sardinella macrophthalmus, Jordan and Evermann, 1896a, pp. 428 (characters in key), 430 (description; comparison; range; synonymy in part); 1896b, p. 282 (range).—Jordan and Rutter, 1898, p. 94 (references; depth of body; Kingston, Jamaica).—Fowler, 1900, p. 118 (Port Antonio, Jamaica; St. Martin and Santa Cruz, Lesser Antilles).—Nichols, 1912, p. 182 (method of capture; Habana Harbor, Cuba).—Metzelaar, 1919, p. 12 (synonymy; size; common name; habitat; commercial importance; Curaçao, St. Eustatius), fig. 4 (drawing).—Breder, 1927, p. 12 (material in part; Glover Reef); 1929, p. 68 (range; occurrence; size); 1934, p. 59 (Deep Creek, Andros Island, Bahamas).—Beebe and Tee-Van, 1928, p. 41 (common name; references; field characters; size and weight; general range; distribution in Port-au-Prince Bay; abundance; method of capture; study material; Port-au-Prince Bay, Haiti).—Parr, 1930, p. 3 (comments; material from Crooked Islands, Bahamas, only).—Von Ihering, 1930, p. 229 (references; diagnosis; Brazil).

Cuvier and Valenciennes (1847, p. 291), in their description of *H. clupeola*, thought that a drawing made by Poey and bearing the vernacular name "Sardina de España" represented this species. This

1, 2, *Harengula thrissina:* From 2 specimens 68 and 92 mm. in length (B.O.C. No. 1154) collected at San José, Lower California, Mexico. 3, 4, *H. peruana:* From 2 specimens 58 and 72 mm. in length (U.S.N.M. No. 79516) collected at Taboga (Pearl) Island, Panama Bay. 5, 6, *H. clupeola:* From 2 specimens 79 and 95 mm. in length (U.S.N.M. No. 123755) collected at Habana, Cuba. 7, 8, *H. pensacolae pensacolae:* From 2 specimens 74 and 98 mm. in length (U.S.N.M. No. 123748) from Key West, Fla.

Three southern subspecies of *Harengula pensacolae*: 1, *H. p. majorina*, from a specimen 140 mm. in length (U.S.N.M. No. 128281) collected at Estanques Bay, Gulf of Venezuela; 2, *H. p. floridana*, from the holotype, 128 mm. in length (U.S.N.M. No. 62584), collected at Old Rhodes Key, Fla.; 3, *H. p. caribbaea*, from the holotype, 103 mm. in length (U.S.N.M. No. 79534), collected in Fox Bay, Colón, Panama.

name has always been applied to *Sardinella anchovia* Cuvier and Valenciennes (1847, p. 269; see also Poey, 1860, p. 311, and Hubbs, 1929, p. 264), an entirely different species, but resembling *H. clupeola* in external appearance. Later, Guichenot (1853, p. 230) also erroneously applied the vernacular name "Sardina de España" to *H. clupeola*.

I have examined the material (U. S. N. M. No. 4795, Poey's orig. No. 377) recorded by Poey (1861, p. 384; 1868, p. 418) as *Harengula* species dubia and reported upon by Storey (1938, p. 49). There are two specimens 107 and 109 mm. in length in this lot from Cuba, and both are *H. clupeola*.

Günther's description of his *Clupea humeralis* (1868, p. 422) was almost certainly based on specimens of *H. clupeola*, *H. pensacolae pensacolae*, and *H. pensacolae majorina*, as may be inferred, especially from the character involving the height of the body measured into the length: "twice and three fourths to thrice and a half" (about 2.7 to 3.5). In *H. clupeola* the height of the body is contained 2.9 to 3.6, usually 3.0 to 3.5, in the length, and usually 2.5 to 2.9 in *H. pensacolae* and its subspecies. His synonymy and the localities recorded tend to confirm the above statement.

The material (U. S. N. M. Nos. 41316, 41332, and 131300) recorded from Port Castries, St. Lucia, as *Harengula macrophthalma* by Jordan (1890a, pp. 645, 646) is *H. clupeola*, and that (U. S. N. M. Nos. 37080 and 37114) recorded from Cozumel, Yucatán, as *H. pensacolae* by T. H. Bean (1890, p. 206) is *H. clupeola*.

This species, recorded by Jordan and Evermann (1896a, pp. 428, 429) as *Sardinella clupeola*, was erroneously described by them as having 33 ventral scutes. Their *S. macrophthalmus*, now known to be a synonym of *Harengula clupeola*, was recorded in the key (p. 428) as having only 25 to 28 ventral scutes. The range of variation in the number of ventral scutes in *H. clupeola* is 29 to 32, usually 30 or 31 (see table 1). None of the American forms of *Harengula* so far as known, have more than 32 ventral scutes.

The figure identified by Metzelaar (1919, p. 10, fig. 2) as *Sardinella anchovia* was based on a specimen of *H. clupeola*. This is confirmed not only by the general appearance of the fish but also by certain measurements taken on the figure.

The material reported upon by Breder (1927, pp. 12, 13) as *Sardinella macrophthalmus* has been examined. Only seven of the nine specimens recorded from Glover Reef have been found to be *Harengula clupeola;* the rest of the material is *H. humeralis* (see p. 284).

I have studied the material recorded by Parr (1930, p. 3) as *Sardinella macrophthalmus* and find that the single aberrant specimen 55 mm. in length (B.O.C. No. 2554) from Crooked Island, Bahamas, is *H. clupeola*. Its head is very long, 3.0 in length, and the eye unusually large for this species; its diameter is contained 2.6 times in the

length of the head and is much greater than the least depth of the caudal peduncle, whereas in normal specimens of *H. clupeola* it is always less. The remaining lot (B.O.C. No. 2550) is *H. pensacolae pensacolae*.

As already pointed out by Longley (*in* Longley and Hildebrand, 1941, p. 11), *H. clupeola* shows a difference in the depth of the body according to sex, the females, especially the ripe ones, being deeper than the males. In medium-sized and smaller specimens this difference is much less or not at all noticeable.

Although this species attains a farily large size, large individuals are not often collected. The usual length is 70 to 85 mm. The largest specimen examined (U.S.N.M. No. 116872, specimen No. 25) measures 149 mm. in length and was collected by W. H. Longley at Tortugas, Fla., along with several others of large size.

Harengula clupeola is abundant throughout the West Indies, where it is of commercial value as food and as bait for snappers and groupers. Large quantities are caught for bait with seines and cast nets in estuaries and in bays. The medium-sized and small specimens are best suited for bait. Commercial and amateur fishermen congregate at the two bridges near the mouth of Río Almendares, Habana, Cuba, during the proper season, in order to catch this fish, using a short pole and a tiny hook baited with shrimp.

This is the most widely distributed of the American forms and has almost the same range as *Harengula humeralis*. It is known from the Florida Keys, Bahamas, West Indies, and Atlantic coast of Central and South America, from Yucatán to Brazil. The occurrence of *H. clupeola* in northern Brazil was established by a specimen (U.S.N.M. No. 118470) 44 mm. in length, collected by R. von Ihering, in Recife (Pernambuco). This species has been recorded from Bermuda as *H. macrophthalmus* by Beebe and Tee-Van (1933, p. 36), but this record is not supported by specimens and needs confirmation.

The material examined was in 29 lots with 198 specimens.

6. HARENGULA PENSACOLAE MAJORINA Storey

SARDINA; SARDINE; SARDINA ESCAMUDA; SARDINHA; SPRAT

PLATE 4, FIGURE 1

Harengula humeralis (not *Clupea humeralis* Cuvier, 1829, p. 318), CUVIER and VALENCIENNES, 1847, p. 293 (description; comments; localities in part: Guadeloupe, Rio de Janeiro to the West Indies, Brazil, Bahia, Surinam).—CASTELNAU, 1855, p. 56 (references in part; comments; Bahia, Brazil).—JORDAN, 1891, p. 314 (material; Bahia, Brazil).

Clupea humeralis, GÜNTHER, 1868, p. 422 (synonymy and references in part; description in part; range in part; material in part).—JORDAN, 1887b, p. 561 (synonymy excluded; West Indies).

Harengula arcuata (not *Clupea arcuata* Jenyns, 1842, p. 134), JORDAN, 1890, pp. 645 (listed), 646 (characters; material and synonymy in part; St. Lucia).

Sardinella humeralis (not *Harengula humeralis* Cuvier and Valenciennes, 1847, p. 293), JORDAN and EVERMANN, 1896a, pp. 428 (characters in key), 431 (common names in part; description in part; range in part; synonymy and references in part); 1896b, p. 283 (common names in part; range in part; reference).—METZELAAR, 1919, p. 11 (partial synonymy; size; common and doubtfully poisonous; common name; habitat; Curaçao; St. Eustatius).

Harengula pensacolae (not of Goode and Bean, 1879, p. 152), REGAN, 1917, p. 389 (synonymy in part; description in part; material in part; Florida excepted; Trinidad).—FOWLER, 1919, p. 129 (Rio de Janeiro, Brazil).

Harengula majorina STOREY, 1938, pp. 7, 18, 21, 23, 25, 32, 42, 44, 50, 51, figs. 1, 8, 9, 17 (characters; relationships; comparisons; range; synonymy; diagnosis; material; comments; nomenclatorial notes; West Indies, St. Lucia, Santos, Province of São Paulo, Brazil).—FOWLER, 1940a, p. 745 (drawing; Rio de Janeiro, Brazil); 1941, p. 133 (references; Brazil).—HILDEBRAND, *in* Longley and Hildebrand, 1941, p. 11 (comments).

Before it had been given a name and properly described by Storey (1938, p. 7) this form was incorrectly called *H. humeralis* Cuvier and Valenciennes (1847, p. 293) by authors. Storey (1938, p. 50) has proved that Cuvier and Valenciennes's description of *H. humeralis* was almost certainly based on material of *H. pensacolae majorina* but that the name *humeralis* cannot be applied to this subspecies.

The material (U. S. N. M. Nos. 41337 and 123753) collected by the *Albatross* at Port Castries, St. Lucia, in November 1888 and erroneously recorded by Jordan (1890, p. 646) as *H. arcuata* is *H. pensacolae majorina*, although characters given in his key were based on material of *H. pensacolae pensacolae*.

Regan's description of *H. pensacolae pensacolae* applies to *H. pensacolae majorina*, since it was based on material of both subspecies; the specimens from Florida are *H. pensacolae pensacolae*, and those from Trinidad are *H. pensacolae majorina*. The characters used in the description, including the number of gill rakers, are common to both subspecies (see items 6*b* and 3*b* of the key).

A single specimen (U. S. N. M. No. 100833) 124 mm. in length, from Pôrto Inhauma, Brazil, although falling within the range of variation of *Harengula pensacolae majorina* in most counts and proportions, differs in the following characters: The body is much more compressed and the fins are longer, especially the caudal, which in addition is not fully scaled. The scales are thinner and those at middle of sides below the dorsal fin are deeper. The margin of the dorsal fin is much more concave. The ventral fin is inserted nearer the pectoral base than the anal origin (about midway in typical *H. pensacolae majorina*). This specimen may be simply aberrant or it may represent a hitherto undescribed additional subspecies of *Harengula pensacolae*. More specimens are needed before the question can be definitely settled.

H. pensacolae majorina has occasionally been confused with *H. pensacolae pensacolae*, which it closely resembles in external appearance and proportions (Regan, 1917, p. 389, and Fowler, 1919, p. 129). However, the two can be separated by the number of gill rakers and ventral scutes (see table 1 and items 3*a* and 3*b* of the key).

TABLE 2.—*Frequency distribution of eye in greatest depth of body, in* Harengula pensacolae majorina *and* H. pensacolae caribbaea

Subspecies	Length	Eye in greatest depth of body														
		3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5
H. pensacolae majorina	40–140	----	----	----	2	5	11	10	10	7	5	3	2	1	1	1
H. pensacolae caribbaea	39–110	2	6	11	32	17	11	11	7	2	2	2	1	----	----	----

TABLE 3.—*Frequency distribution of head depth at occiput in length, in specimens of the same length (43 to 79 mm.) of* Harengula pensacolae cubana *and H.* pensacolae floridana.

Subspecies	Head depth at occiput in length							
	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1
H. pensacolae cubana	------	1	4	8	3	3	1	1
H. pensacolae floridana	1	7	6	4	3	------	------	------

The usual length of this subspecies is 59 to 85 mm. The largest specimen examined (U. S. N. M. No. 128281) measures 140 mm. and was collected by the U. S. S. *Niagara* in Estanques Bay, Gulf of Venezuela, on December 8, 1924.

This subspecies probably is used as food as well as bait throughout its range.

The known range of *H. pensacolae majorina* comprises the West Indies from St. Lucia southward and the Atlantic coast of South America, from Venezuela to Brazil. It is found in company with *H. clupeola* throughout its range and with *H. humeralis* in the West Indies and Venezuela.

7. HARENGULA PENSACOLAE CARIBBAEA, new subspecies

SARDINA; SARDINA ESCAMUDA; SARDINE; SPRAT

PLATE 4, FIGURE 3

Clupea humeralis, GÜNTHER, 1868, p. 422 in part (synonymy and references excluded; description; range; material).—COPE, in part, 1871, p. 483 (references; St. Croix).—JORDAN, 1887b, p. 561 (synonymy excluded, West Indies).

Sardinella humeralis (not *Harengula humeralis* Cuvier and Valenciennes, 1847, p. 293), EVERMANN and MARSH, 1902, p. 85 (characters in key; common names; description; material; synonymy in part; San Juan, Palo Seco,

Mayagüez, Puerto Real, Boquerón, Arroyo, Húcares, Culebra, and San Gerónimo, Puerto Rico).—Fowler, 1900, p. 118 in part (Port Antonio, Jamaica); 1911, p, 206 (localities); 1915b, p. 50 (Santo Domingo); 1917, p. 128 (material; Colon, Panama).

Harengula pensacolae (not of Goode and Bean, 1879, p. 152), Fowler, 1919, pp. 133 (St. Martin Island, West Indies), 144 (St. Croix); 1928, pp. 456 (material; Haiti), 462 (material; Puerto Rico).

Sardinella macrophthalmus (not *Clupea macrophthalma* Ranzani, 1842, p. 320), Meek and Hildebrand, 1923, pp. 182, 184, pl. 9*a* (characters in key; synonymy in part; description; comments; material; range in part; Toro Point, Colón, and Porto Bello, Panama).

Harengula sardina (not of Poey, 1860, p. 310), Fowler, 1937, p. 309 (Port-au-Prince, Haiti).

Harengula majorina (not of Storey, 1938, p. 32), Fowler, 1944, pp. 144 (synonymy and references in part; description; material; compared to *H. pensacolae;* St. Andrews Island), 457 (localities; references in part; western Caribbean), fig. 29.

The holotype is an adult 103 mm. in length (U. S. N. M. No. 79534), collected by S. E. Meek and S. F. Hildebrand, in Fox Bay, Colón, Panama, on January 27, 1912. Forty-nine paratypes 32 to 43 mm. in length (U. S. N. M. No. 79515) were collected with the holotype. Other paratypes: U. S. N. M. No. 79498, 47 specimens 51 to 75 mm. in length, collected by Meek and Hildebrand, at Porto Bello, Panama, on March 19, 1912; No. 79538, 3 specimens 61 to 109 mm. in length, collected by Meek and Hildebrand at Porto Bello, Panama, on April 24–28, 1911; No. 79537, a specimen 107 mm. in length, collected by Meek and Hildebrand, at Toro Point, Limón Bay, Canal Zone, Panama, on May 19, 1911; No. 128360, 13 specimens 84 to 102 mm. in length, collected by J. B. Shropshire, at Toro Point, Limón Bay (Fort Sherman), Canal Zone, Panama, in April 1937.

H. pensacolae caribbaea differs from *H. pensacolae pensacolae* in the number of gill rakers, and from *H. pensacolae majorina* in the number of ventral scutes and the size of the eye (see tables 1 and 2 and items 7*a* and 7*b* of the key). The holotype has 33 gill rakers and 29 ventral scutes.

This subspecies is based on the material recorded by Meek and Hildebrand (1923, p. 184) from Panama as *Sardinella macrophthalmus.* In their description they give the number of gill rakers as "about 32," but my counts show that they vary from 31 to 37, usually 33 or 34 (see table 1).

The material (U.S.N.M. Nos. 63062, 73833, and 76506) recorded by Evermann and Marsh (1902, p. 85) as *Sardinella humeralis,* from Palo Seco and San Juan, Puerto Rico, has been examined and found to be *H. pensacolae caribbaea.* I have not been able to locate in the collections of the U. S. National Museum the rest of the material recorded by them from Mayagüez, Puerto Real, Boquerón, Arroyo, Húcares, Culebra, and San Gerónimo, or the material (U.S.N.M. Nos. 30080

and 30139) recorded from Jamaica by Bean and Dresel (1884, p. 169) as *Clupea humeralis*. These specimens could be *H. pensacolae caribbaea*, but they cannot be definitely recorded as such without an actual examination of the material.

The usual length of this subspecies is 48 to 61 mm. The largest specimen examined (U.S.N.M. No. 94758) was 110 mm. in length and was collected by Brother Elias at Puerto Colombia, Colombia, in 1935.

This subspecies occurs along the Atlantic (Caribbean) coast of Central and South America, from Nicaragua to Colombia, and in Jamaica, Hispaniola, and Puerto Rico, in the West Indies, where it is found in company with *H. clupeola*. It is collected with *H. humeralis* in Colón, Panama.

Named for the Caribbean Sea.

8. HARENGULA PENSACOLAE PENSACOLAE Goode and Bean

SARDINE; SCALED SARDINE; ALEWIFE; FAT-BACK MINNOW; PILCHARD; SHINER

PLATE 3, FIGURES 7–8

Clupea humeralis (not of Cuvier and Valenciennes, 1847, p. 293), GUNTHER, 1868, p. 422 (synonymy and references excluded; description in part; range in part; material in part).

Harengula pensacolae GOODE AND BEAN, 1879, p. 152 (original description; comparisons; material; Pensacola, Fla.); 1880, p. 343 (material; characters; Clear Water Harbor, Fla.).—JORDAN and GILBERT, 1882a, p. 268 (description).—LÖNNBERG, 1894, p. 114 (abundance; method of capture; use; St. Petersburg, Fla.).—REGAN, 1917, pp. 387 (characters in key), 389 (synonymy and references; description in part; material in part; exclude Trinidad).—JORDAN, 1918, p. 46 (validity; Atlantic coast).—FOWLER, 1919, p. 151 (habitat; behavior; method of capture; Useppa Island, Fla.); 1926, p. 250 (material; size; coloration; Boca Grande, Fla.); 1933, p. 58 (material; size; Calcasieu Lake, La.); 1940b, p. 2 (material; size; Boca Grande, Fla.); 1945, pp. 104 (common name, synonymy, and references; material; size; use; Elizabeth City, N. C.); 266 (common name; material; Del Rey, Marco Bay, Key West, Big Matecumbe Key, Card Sound, Fla.).—JORDAN, EVERMANN, and CLARK, 1930, p. 44 (range; Florida).—LONGLEY, 1932, p. 299 (nomenclature). HUBBS, 1936, p. 174 (material; characters; nomenclatorial notes; comparisons; Champotón, Campeche, Yucatán).—STOREY, 1938, pp. 3, 7, 13, 15, 18, 21, 23, 25, 33, 50, figs. 1, 2, 4–11, 13 (relationships; range, characters; compared with *H. majorina;* description; diagnosis;; material; Key West, Florida Keys, Cape Sable, Egmont Key, Cedar Keys, and Pensacola, Fla.; Galveston, Tex., Yucatán, Mexico).—HILDEBRAND, *in* Longley and Hildebrand, 1941, p. 11 (a synonym of *H. macrophthalma*; gill rakers).

Clupea pensacolae, JORDAN, 1884, p. 107 (common name; abundance; comparisons; coloration; Key West, Fla.); 1887a, p. 36 (North America).—JORDAN and SWAIN, 1884, p. 230 (coloration; relationship; Cedar Keys, Fla.).—HENSHALL, 1891, p. 385 (abundance; occurrence; range; Florida Keys and west coast of Florida).

Harengula arcuata (not *Clupea arcuata* Jenyns, 1842, p. 134), JORDAN, 1890, p. 646 (characters in key; material in part; Cedar Keys and Key West only).—HENSHALL, 1891, p. 373 (common name; synonymy in part; abundance;

occurrence; Cape Sable Creek, Marco; San Carlos Pass; Big Gasparrilla; Egmont Key, Fla.).—Evermann and Kendall, 1894, p. 105 (material; comparisons; Galveston and Corpus Christi, Tex.).

Sardinella humeralis (not *Harengula humeralis* Cuvier and Valenciennes, 1847, p. 293), Jordan and Evermann, 1896a, pp. 428 (characters in key), 431 (common names in part; description in part; range in part; synonymy and references in part; types of *Harengula pensacolae* designated); 1896b, p. 283 (common names in part; range in part; reference excluded).—Cockerell, 1910, p. 63 (description of scales; Tampa, Fla.).—Fowler, 1911, p. 206 (localities in part: Florida and ? Rhode Island only).

Harengula humeralis (not of Cuvier and Valenciennes, 1847, p. 293), Jordan and Thompson, 1905, p. 233 (abundance; used as bait; Tortugas, Fla.).—Fowler, 1906, p. 83 (coloration; material; preservation; Marquesas Keys and Hailer's Rock, Fla.), fig. 3 (drawing); 1915a, p. 247 (Clearwater and Palm Beach, Fla.).

Harengula macrophthalma (not *Clupea macrophthalma* Ranzani, 1842, p. 320), Gunter, 1945, pp. 25, 128 (occurrence; abundance; method of capture; salinity and temperature; size; Copano Bay, Aransas Bay, Lydia Ann Channel, Texas).

The original description of this species (Goode and Bean, 1879, p. 152) was based on two specimens, 124 and 132 mm. in length, U.S.N.M. No. 22831, collected by S. Stearns at Pensacola, Fla., in 1878. Later, Jordan and Evermann (1896, p. 431) erroneously designated U.S.N.M. No. 22829 as types. They probably thought that the number (29) in parentheses, which is indicated after U.S.N.M. No. 22831 (in the original description), meant 22829. The 29 is the original number of the lot, and U.S.N.M. No. 22829, which has been destroyed, corresponds to a cast of the salmonid fish *Oncorhynchus quinnat=O. tschawytscha* (Walbaum). The specimen 132 mm. in length, in U.S.N.M. No. 22831, is designated here as the lectotype.

H. pensacolae pensacolae was synonymized with *H. macrophthalma=H. clupeola* by Longley and Hildebrand (1941, p. 10) on the basis of the increase in the number of gill rakers with age, shown by their material from the Tortugas: "Specimens of *H. macrophthalma* 31 to 44 mm. long had about 28 to 33 rakers on the lower limb of the first arch, whereas larger specimens, ranging upwards of 125 mm. in length, had about 29 to 36." I have examined the material (*H. clupeola*, U.S.N.M. No. 116872) referred to in the above quotation as "larger specimens," and only one out of 25 specimens (118 to 149 mm. in length) counted had 36 gill rakers; the rest ranged from 28 to 34, usually 30 to 32. Very young specimens of *H. pensacolae pensacolae* (below a standard length of 40 mm.) have a gill-raker count within the total range of *H. clupeola*, but in young specimens of the same size of the latter species the number of gill rakers is always lower than in *H. pensacolae pensacolae*. In addition to the number of gill rakers, *H. pensacolae pensacolae* differs from *H. clupeola*, in the ventral-scute count (see items 3*a* and 3*b* of the key and table 1) and in the deeper head and

body. The differences between *H. pensacolae pensacolae* and *H. clupeola* have already been shown by Hubbs (1936, p. 175) and Storey (1938).

As pointed out by Storey (1938, p. 35), *H. pensacolae pensacolae* shows great variation in the size of the eye. This is especially true of southern Florida and the Yucatán material, but a careful study of the extensive number of specimens at hand fails to show a geographical correlation that would justify the erection of a new subspecies on the basis of this character.

The relationships of this species with *H. pensacolae caribbaea* and *H. pensacolae majorina*, its closest relatives, were discussed on pages 294 and 295.

The usual size of *H. pensacolae pensacolae* is 58 to 82 mm. in length. Large individuals are not often collected, but the largest specimen examined (U.S.N.M. No. 93873) was 149 mm. and was collected by Danglade with another specimen 141 mm. in length off Alligator Reef, Florida Keys.

H. pensacolae pensacolae occurs along the Atlantic coast of the United States north to Cape Canaveral, Fla., throughout the Florida Keys, and along the Gulf coast of the United States and Mexico to Yucatán. It may be found in company with *H. humeralis*, *H. clupeola*, and *H. pensacolae floridana* throughout the Florida Keys. Along the north coast of Yucatán it is found with *H. humeralis* and *H. clupeola*. So far as known, it is the only species of *Harengula* inhabiting the Gulf coast of the United States.

In addition to the type specimens, 55 lots with 870 specimens were examined.

9. HARENGULA PENSACOLAE CUBANA, new subspecies

SARDINA ESCAMUDA

FIGURE 40; PLATE 5, FIGURES 1–3

The holotype is an adult (U.S.N.M. No. 132472) 104 mm. in length, collected by Paul Bartsch (Smithsonian-Roebling Expedition) at Buenavista Anchorage (Cayo Buenavista), Province of Pinar del Río, northwestern Cuba, on April 6, 1937. Thirty-one paratypes 82 to 109 mm. in length (U.S.N.M. No. 124308) were collected with the holotype. There are also 83 paratypes 21 to 80 mm. in length (U.S.N.M. No. 82321) collected by Henderson and Bartsch (Tomás Barrera Expedition) at Ensenada de Santa Rosa, Province of Pinar del Río, northwestern Cuba, on May 18, 1914.

Predorsal contour evenly convex the back not elevated; distance between origin of dorsal fin and axis of body 2.2 (2.2 to 2.7, usually 2.3 to 2.6) in head. Greatest depth of body 3.0 (2.9 to 3.3, usually 3.0 or 3.1) in length; 1.4 (1.3 to 1.6, usually 1.4 or 1.5). Head 3.4

1–3, *Harengula pensacolae cubana:* 1, From a paratype 93 mm. in length (U.S.N.M. No. 124308) collected at Buenavista Anchorage, Province of Pinar del Río, Cuba; 2, 3, from 2 paratypes 66 and 77 mm. in length (U.S.N.M. No. 82321) collected at Ensenada de Santa Rosa, Province of Pinar del Río, Cuba. 4–6, *H. p. pinensis:* 4, From the holotype, 86 mm. in length (U.S.N.M. No. 107399), from the Isle of Pines, Cuba; 5, 6, from 2 paratypes 67 and 73 mm. in length (U.S.N.M. No. 124319) collected with the holotype.

(3.1 to 3.4, usually 3.2 or 3.3) in length; 1.7 (1.5 to 1.7) in predorsal length; 1.2 (0.9 to 1.3, usually 1.0 to 1.2) in greatest depth of body. Greatest width of head 2.0 (1.8 to 2.3, usually 1.9 to 2.2) in its length; 2.3 (2.1 to 2.4, usually 2.2 or 2.3) in greatest depth of body. Head depth at occiput 3.8 (3.7 to 4.0, usually 3.8 or 3.9) in standard length. Caudal peduncle slender, its least depth 2.8 (2.6 to 3.0, usually 2.7 to 2.9) in head; 2.1 (2.1 to 2.6, usually 2.2 to 2.5) in distance between occiput and tip of snout; 1.0 (0.9 to 1.2, usually 1.0 or 1.1) in eye. Distance between origin of dorsal fin and tip of snout (predorsal length) 2.2 (2.1 or 2.2) in length; distance between origin of dorsal fin and caudal base 1.8 (1.7 to 1.9, usually 1.8) in length. Distance between origin of anal fin and caudal base 1.2 (1.1 to 1.4, usually 1.2 or 1.3) in head. Interorbital 4.6 (4.2 to 5.2, usually 4.3 to 5.1) in head; 2.0 (1.7 to 2.1, usually 1.8 to 2.0) in eye. Eye large, equal to or greater than least depth of caudal peduncle and exceeding its vertical distance above ventral contour of head; 2.7 (2.5 to 2.9, usually 2.6 to 2.8) in head; 3.4 (2.6 to 3.6, usually 2.8 to 3.4) in greatest depth of body; 2.6 (2.1 to 2.9, usually 2.3 to 2.7) in distance between insertion of pelvic and origin of anal; 4.4 (3.6 to 4.4, usually 3.7 to 4.3) in predorsal length. Snout 3.7 (3.6 to 4.0, usually 3.7 to 3.9) in head; 1.4 (1.2 to 1.6, usually 1.3 to 1.5) in eye. Maxillary, 2.1 (2.0 to 2.2) in head, reaching beyond vertical from anterior margin of pupil.

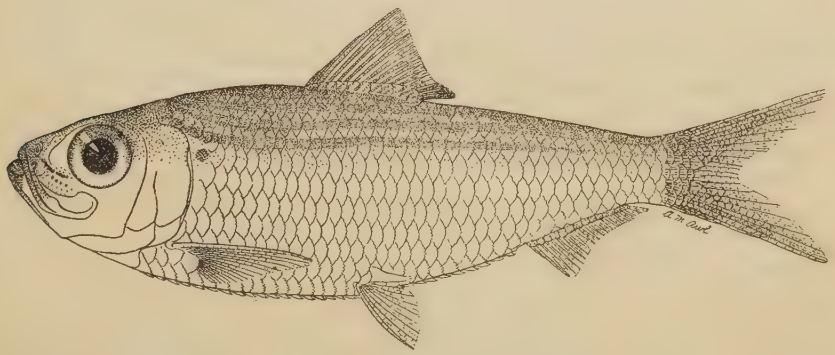

FIGURE 40.—*Harengula pensacolae cubana*, new subspecies: From the holotype, 104 mm. in length (U.S N.M. No. 132472), collected at Buenavista Anchorage, Province of Pinar del Río, Cuba.

Dorsal rays 18 (17 to 20, usually 18); anal 18 (17 to 19, usually 18); pectoral 16 (13 to 17, usually 15 or 16); pelvic 8 (7 to 9, usually 8). Dorsal base 1.8 (1.7 to 2.2, usually 1.8 to 2.1) in head; anal base 2.1 (1.9 to 2.5, usually 2.1 to 2.4) in head. Pectoral fin 1.3 (1.3 to 1.5 in head); pelvic 2.1 (2.1 to 2.4, usually 2.2 or 3.3) in head. Origin of dorsal fin usually nearer origin of anal than tip of snout. Insertion of pectoral about midway between tip of snout and insertion of pelvic. Distance between insertions of pectoral and pelvic fins 3.4 (3.3 to 3.8,

usually 3.4 to 3.7) in standard length; 1.0 (0.9 to 1.2, usually 1.0 or 1.1) in head; 1.2 (1.1 or 1.2) in greatest depth of body. Insertion of pelvic fin, nearer caudal base than tip of snout; about midway between insertion of pectoral and origin of anal. Distance between insertion of pelvic and anal origin 3.7 (3.2 to 3.9, usually 3.3 to 3.8) in standard length; 1.1 (0.9 to 1.2, usually 1.0 or 1.1) in head. Origin of anal much nearer caudal base than to insertion of pelvics.

Gill rakers 39 (34 to 40, usually 35 to 39) on lower limb of first arch. Ventral scutes 30 (29 to 31, usually 29 or 30). Scales thick and adherent, not glassy, in 41 (39 to 43, usually 40 to 42) transverse rows, and 11 (11) longitudinal rows. Predorsal scales 12 (11 to 14, usually 12 or 13).

TABLE 4.—*Frequency distributions of eye in head, and in greatest depth of body, in specimens of the same length (67 to 86 mm.), of* Harengula pensacolae cubana *and* H. pensacolae pinensis.

Subspecies	Eye in head					Eye in greatest depth of body									
	2.6	2.7	2.8	2.9	3.0	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
H. pensacolae cubana	12	4	2	1	----	1	----	4	4	4	3	2	1	----	----	----
H. pensacolae pinensis	----	----	1	3	2	----	----	----	----	----	----	----	1	1	2	2

TABLE 5.—*Frequency distributions of greatest width of head in greatest depth of body, least depth of caudal peduncle in head, and greatest depth of body in length, in specimens of the same length (67 to 86 mm.) of* Harengula pensacolae cubana *and* H. pensacolae pinensis.

Subspecies	Width of head in depth of body						Depth of caudal peduncle in head								Depth of body in length				
	2.1	2.2	2.3	2.4	2.5	2.6	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	2.8	2.9	3.0	3.1	3.2
H. pensacolae cubana	2	5	11	1	----	----	----	----	----	2	4	6	3	4	----	1	6	10	2
H. pensacolae pinensis	----	----	----	1	4	1	1	4	----	1	----	----	----	----	2	3	1	----	----

TABLE 6.—*Frequency distributions of greatest depth of body in predorsal length, distance between origin of dorsal fin and axis of body in head, and interorbital in eye, in specimens of the same length (67 to 86 mm.) of* Harengula pensacolae cubana *and* H. pensacolae pinensis.

Subspecies	Greatest depth of body in predorsal length					Distance between origin of dorsal fin and axis of body in head							Interorbital in eye						
	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	2.4	2.5	2.6	2.7	1.5	1.6	1.7	1.8	1.9	2.0	2.1
H. pensacolae cubana	----	----	9	8	2	----	----	2	5	6	5	1	----	----	----	5	8	5	1
H. pensacolae pinensis	3	3	----	----	----	2	4	----	----	----	----	----	1	1	4	----	----	----	----

General coloration (in 70 percent alcohol) silvery, especially on the lower half of the head and body; the opercular plates and the ventral scales with bluish-green or pearlish metallic reflections. Back bluish gray, this coloration changing abruptly into silvery at about one-fourth of the distance to the ventral contour. Sides of body crossed by longitudinal streaks, more conspicuous on the back. Humeral spot always present; usually conspicuous, occasionally faint. Tip of snout and mandible dusky. Upper sector of iris black. Dorsal fin slightly pigmented but not blackish; pectoral, pelvic, and anal fins colorless; caudal fin more heavily pigmented than the dorsal, the inner edges of the lobes fringed with dusky, almost turning to black toward the tips.

This subspecies is closely related to *H. pensacolae pensacolae*, from which it differs in the characters given in items 8*a* and 8*b* of the key. In general appearance *H. pensacolae cubana* somewhat resembles *H. humeralis*, especially in the large eye and the shape of the body, but the number of gill rakers and ventral scutes, the thick and adherent scales, and other characters (see key) separate both forms.

The usual length attained by *H. pensacolae cubana* is 48 to 63 mm. The largest specimen at hand is a paratype (U. S. N. M. No. 124308) 109 mm. in length.

H. pensacolae cubana is used as food as well as bait throughout its range. It is captured mostly with cast nets.

This subspecies is found in company with *H. humeralis*, along the north coast of western Cuba (Province of Pinar del Río), including the Colorados Reefs, from Ensenada de Matahambre to Cape Cajón.

In addition to the type specimens listed, 14 lots with 52 specimens were examined. Named after Cuba, to which island this subspecies seems to be confined.

10. HARENGULA PENSACOLAE FLORIDANA, new subspecies

SARDINE; SCALED SARDINE

PLATE 4, FIGURE 2

The holotype is an adult 128 mm. in length (U.S.N.M. No. 62584) collected by B. A. Bean (yacht *Orion*) in Old Rhodes Key, Fla., on December 14, 1908. The following are paratypes: U. S. N. M. No. 123750, 15 specimens 40 to 58 mm. in length, collected by S. F. Hildebrand and W. C. Schroeder at Martello Tower, Key West, on July 3, 1919, and No. 125311, 14 specimens 33 to 77 mm. in length, collected by Evermann and Kendall in Key West, Fla., on October 19, 1896.

This subspecies differs from *H. pensacolae cubana* in the depth of the head at occiput, as shown in table 3, and in the characters in items 10*a* and 10*b* of the key.

H. pensacolae floridana is known only from the Florida Keys, from Old Rhodes Key to Key West. Throughout its range it is found in

company with *H. humeralis*, *H. clupeola*, and *H. pensacolae pensacolae*. A specimen of *pensacolae* 110 mm. in length was collected with the holotype of *H. pensacolae floridana*.

Named for the State of Florida, to the southern part of which this subspecies seems to be confined.

11. HARENGULA PENSACOLAE PINENSIS, new subspecies

SARDINA ESCAMUDA

FIGURE 41; PLATE 5, FIGURES 4–6

The holotype is an adult 86 mm. in length (U.S.N.M. No. 107399), collected by Paul Bartsch (Smithsonian-Reobling Expedition) in the Isle of Pines, opposite Siguanea Island, Cuba, on April 11, 1937. Five paratypes, 67 to 73 mm. in length (U.S.N.M. No. 124319), were collected with the holotype.

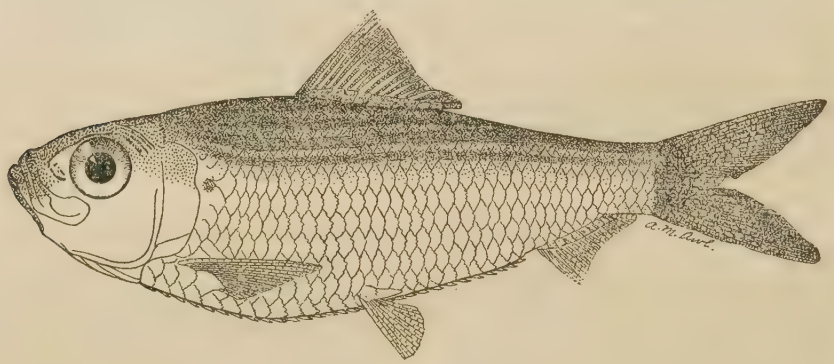

FIGURE 41.—*Harengula pensacolae pinensis*, new subspecies: From the holotype, 86 mm. in length (U.S N.M. No. 107399), collected in the Isle of Pines, Cuba.

This subspecies is related to *H. pensacolae pensacolae* and more closely so to *H. pensacolae floridana* and *H. pensacolae cubana*. It differs from *H. pensacolae pensacolae* in the characters given in item 8*b* of the key. Owing to the small number of specimens of *H. pensacolae pinensis* available, it has been found necessary to present several frequency distribution tables based on specimens of the same size in order to show the differences between this subspecies and *H. pensacolae cubana* in a more comprehensive manner.

H. cubana pinensis is as yet known only from the type locality.

Named after the Isle of Pines, where the type specimens were collected.

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